

07.9.2005

PCT/JP2005/098821

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APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE UNDER 35 USC 111.

APPLICATION NUMBER: 60/605,488

FILING DATE: August 31, 2004

By Authority of the
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21861 U.S. PTO

PTO/SB/16 (10-01)

Approved for use through 10/31/2002. OMB 0851-0032
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No.

EV432881695US

INVENTOR(S)					
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Yoshiho		Gotoh		Osaka, Japan	
<input type="checkbox"/> Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
RECORDING/REPRODUCING METHOD AND APPARATUS FOR A WRITE ONCE OPTICAL DISC					
Direct all correspondence to: CORRESPONDENCE ADDRESS					
<input checked="" type="checkbox"/> Customer Number		000043076		Place Customer Number Bar Code Label here	
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ENCLOSED APPLICATION PARTS (check all that apply)					
<input checked="" type="checkbox"/> Specification		Number of Pages 15		<input type="checkbox"/> CD(s), Number	
<input type="checkbox"/> Drawing(s)		Number of Sheets		<input checked="" type="checkbox"/> Other (specify)	
<input type="checkbox"/> Application Data Sheet. See 37 CFR 1.76		Cert. of Express Mailing			
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT					
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27.		FILING FEE AMOUNT (\$)		18-0988	
<input checked="" type="checkbox"/> A check or money order is enclosed to cover the filing fees		34,243		YAMAP0942US	
<input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:		18-0988		\$160.00	
<input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.					
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
<input checked="" type="checkbox"/> No.					
<input type="checkbox"/> Yes, the name of the U.S. Government agency and the Government contract number are: _____					

Respectfully submitted,

SIGNATURE

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Date 08/30/2004

REGISTRATION NO.
(if appropriate)
Docket Number:

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

[Essence of the Invention]

[Invention 1]

A method to record the data to the logical sector on a write once disc using sequential recording, the method comprising the steps of:

(a) when the physical sector to which corresponding to the logical sector in advance is unrecorded, the data is recorded to the physical sector.

(b) when the physical sector to which corresponding to the logical sector in advance is recorded, the data is recorded to the other unrecorded physical sector in volume space, wherein the assignment of logical sector number in the volume space is not changed.

(c) when the data is recorded to the other unrecorded physical sector in volume space, the logical sector is corresponded to the other unrecorded physical sector.

[Invention 2]

A method according to Invention 1, the method further including the step of:

(d) when the physical sector corresponding to the logical sector in advance is corresponded to the different logical sector, the data is recorded to the other unrecorded physical sector in volume space, wherein the assignment of logical sector number in the volume space is not changed.

[Invention 3]

A method according to Invention 1, when the data is recorded to the other unrecorded physical sector in volume space, the data is recorded to the next writable physical sector in a track.

[Invention 4]

A method according to Invention 1, when the data is recorded to the other unrecorded physical sector in volume space, the unrecorded physical sector in the same track is given priority in recording.

[Invention 5]

A method according to Invention 1, the method further including the step of:

(e) when the data is recorded to the other unrecorded physical sector in volume space, the defect list entry is updated so that the logical sector is corresponded to the other unrecorded physical sector.

[Invention 6]

A recording apparatus to record the data to the logical sector on a write once disc using sequential recording, comprising:

(a) a section for recording the data to the physical sector, when the physical sector to which corresponding to the logical sector in advance is unrecorded.

(b) a section for recording the data to the other unrecorded physical sector in volume space, when the physical sector to which corresponding to the logical sector in advance is recorded, wherein the assignment of logical sector number in the volume space is not changed.

(c) a section for corresponding the logical sector to the other unrecorded physical sector, when the data is recorded to the other unrecorded physical sector in volume space.

[Invention 7]

An apparatus according to Invention 6 further comprising:

(d) a section for recording the data to the other unrecorded physical sector in volume space, when the physical sector corresponding to the logical sector in advance is corresponded to the different logical sector, the data is recorded to the other unrecorded physical sector in volume space, wherein the assignment of logical sector number in the volume space is not changed.

[Invention 8]

An apparatus according to Invention 6, when the data is recorded to the other unrecorded physical sector in volume space, the data is recorded to the next writable physical sector in a track.

[Invention 9]

An apparatus according to Invention 6, when the data is recorded to the other unrecorded physical sector in volume space, the unrecorded physical sector in the same track is given priority in recording.

[Invention 10]

An apparatus according to Invention 6 further comprising:

(e) a section for updating a defect list entry, when the data is recorded to the other unrecorded physical sector in volume space, the defect list entry is updated so that the logical sector is corresponded to the other unrecorded physical sector.

[Invention 11]

A write once disc using sequential recording, all of the logical sector in the volume space is available:

one or more logical sector corresponds to the physical sector in volume space, which physical sector is the different physical sector from one corresponded in advance.

[Invention 12]

A write once disc according to Invention 11:

at least one logical sector is corresponded to the different physical sector from one corresponded in advance, and

at least the other one logical sector which is corresponded to the said different physical sector in advance is corresponded to the other physical sector.

[Invention 13]

A write once disc according to Invention 11:

when a logical sector is corresponded to the different physical sector from one in advance, the different physical sector and the physical sector corresponded in advance are belong to the same track.

[Invention 14]

A write once disc according to Invention 11 comprising the area to record defect list entries:

the defect list entry specifies which logical sector is corresponded to the different physical sector from one corresponded in advance.

[Invention 15]

A method for controlling the recording apparatus to record the data on a write once disc using sequential recording, the recording apparatus records the data with the method comprising the steps of:

(a) when the physical sector to which corresponding to the logical sector in advance is unrecorded, the data is recorded to the physical sector.

(b) when the physical sector to which corresponding to the logical sector in advance is recorded, the data is recorded to the other unrecorded physical sector in volume space, wherein the assignment of logical sector number in the volume space is not changed.

(c) when the data is recorded to the other unrecorded physical sector in volume space, the logical sector is corresponded to the other unrecorded physical sector, the method for controlling the recording apparatus comprising the steps of:

(1) when the data is not needed to overwrite, instructing the recording apparatus so that the data is recorded on the unrecorded logical sector,

(2) when the data is needed to overwrite, instructing the recording apparatus so that the data is overwritten on the recorded logical sector.

[Invention 16]

A method according to Invention 15, the unrecorded logical sector excludes the area where the file is deleted.

[Invention 17]

A method according to Invention 15, the unrecorded logical sector excludes the area where the invalid data is recorded.

[Invention 18]

A method according to Invention 15, further comprising the step of:

(3) inquiring the location information of physically unrecorded area to the recording apparatus.

[Invention 19]

A method according to Invention 18, the location information of physically unrecorded area is next writable address.

[Invention 20]

A method according to Invention 15, the data which is needed to overwrite is the file entry of the directory.

[Invention 21]

A method according to Invention 15, the data which is needed to overwrite is clustered within one or more ECC blocks.

[Invention 22]

An information processing system for controlling the recording apparatus to record the data on a write once disc using sequential recording, the recording apparatus records the data with the method comprising the steps of:

(a) when the physical sector to which corresponding to the logical sector in advance is unrecorded, the data is recorded to the physical sector.

(b) when the physical sector to which corresponding to the logical sector in advance is recorded, the data is recorded to the other unrecorded physical sector in volume space, wherein the assignment of logical sector number in the volume space is not changed.

(c) when the data is recorded to the other unrecorded physical sector in volume space, the logical sector is corresponded to the other unrecorded physical sector, the information processing system for controlling the recording apparatus determining whether the data is needed to overwrite thereof;

(1) when the data is not needed to overwrite, instructing the recording apparatus so that the data is recorded on the unrecorded logical sector,

(2) when the data is needed to overwrite, instructing the recording apparatus so that the data is overwritten on the recorded logical sector.

[Invention 23]

An information processing system according to Invention 22, the unrecorded logical sector excludes the area where the file is deleted.

[Invention 24]

An information processing system according to Invention 22, the unrecorded logical sector excludes the area where the invalid data is recorded.

[Invention 25]

An information processing system according to Invention 22, further comprising;

(3) inquiring the location information of physically unrecorded area to the recording apparatus.

[Invention 26]

An information processing system according to Invention 25, the location information of physically unrecorded area is next writable address.

[Invention 27]

An information processing system according to Invention 22, the data which is needed to overwrite is the file entry of the directory.

[Invention 28]

An information processing system according to Invention 22, the data which is needed to overwrite is clustered within one or more ECC blocks.

[Title of the Invention] METHOD, RECORDING APPARATUS AND INFORMATION PROCESSING SYSTEM ON WRITE-ONCE DISC WITH A PSEUDO-OVERWRITE FUNCTION, AND WRITE-ONCE DISC

[Disclosure of the Invention]

[Problems to be Solved by the Invention]

A new generation write-once media supporting Defect Management is studied. This new generation write-once media has the Spare area to which the data is replaced. An Over-writable function can be realized using the same mechanism with the above defect management.

If this media is used like a rewritable media, many sectors are needed to be replaced. Then, if Spare are is used up, the disc can not be used like rewritable media.

And more, if the defect list entries is used up due to the limited size of the list, the disc can not be also used like rewritable media.

The purpose of this invention is to solve the restriction of the area to be replaced, and to save the defect list entries as necessary as possible.

[Effects of the Invention]

According to the present invention, it is possible to record the data until unrecorded area on write-once disc is used up.

[Detail of the Invention]

The below described invention is used based on ECMA 167 and UDF 2.5.

Pseudo-Overwrite Method

In order to reduce complexity due to physical characteristics, new sequential recording media with overwritable feature is introduced as pseudo-overwritable media. The pseudo-overwrite method is applied to this pseudo-overwritable media.

The followings are the benefit to introduce the new sequential recording media:

- An overwritable volume space and a defect free space are provided, similar as a rewritable media. In other words, compatibility due to write-once media is ensured by a drive unit which supports overwritable mechanism and defect management.
- Session close and Border close are no need to care about, as a real-only drive unit supporting Pseudo-overwrite media has to access to an unrecorded area.
- Metadata Partition and it's mirror can be used.

Pseudo-Overwritable Media

Pseudo-overwritable media supports multi-track recording and overwritable function for all logical sectors in volume space.

More than one track can be used to record. A new track can be assigned as a reserved track within an incomplete track. Sequential recording mode shall be used within a track, to simplify the space management. The pointer to the recordable area is Next Writable Address (NWA), which is get through inquiring to a drive unit.

When the data is intended to record on the recorded logical sector, the data is recorded either within the Spare Area by linear replacement algorithm or to NWA within the volume space. As a merit to remap the data to NWA within the volume space, all available media capacity can be used, even if all of the Spare Area is recorded. Read modify write operation is also supported, therefore, each logical sector can be overwritten separately.

The address information where the data is replaced or remapped from the original address is stored as a defect list entry out of volume space and managed by a drive unit.

Write Strategy

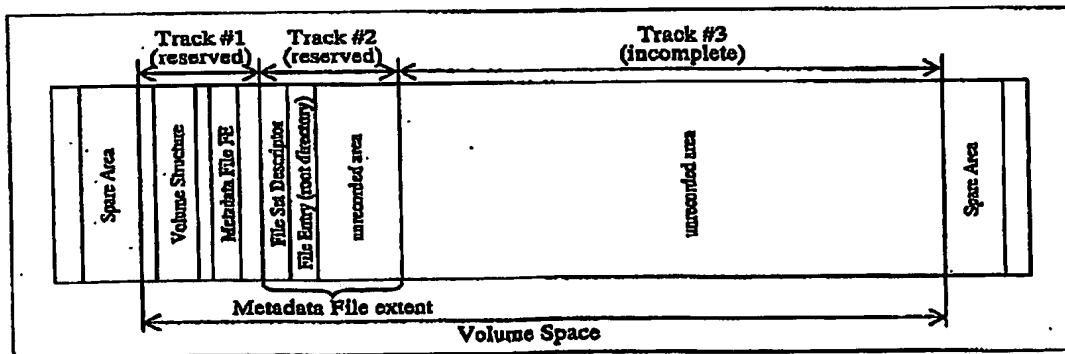
In general, a track can be assigned on considering the data type to be recorded, for example metadata or specific data such as audio/visual data, still picture data, music data. On multi-track recording, when a reserved track is used up, a new track is assigned, adaptable to the amount of recorded data. The track for metadata recording is explicitly indicated as an extent of Metadata File or Metadata Mirror File.

If Pseudo-overwrite media has the restriction that a new track can not be assigned after a track is assigned at the end of the volume space, multi-track recording is used in an intermediate state in which only one AVDP is recorded at

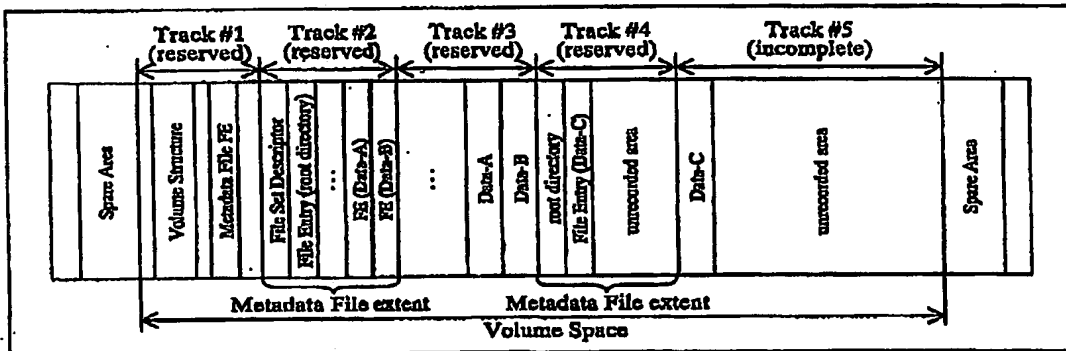
LSN 256. To according with ECMA 167 requirements to record AVDP at least two of three, the track is assigned to record AVDP at Last LSN - 256 or Last LSN. In this case, multi-track recording can not be used due to the restriction for assigning the track.

Metadata Mirror File can be also used. It is recommend to create Metadata Mirror File when the disc is stored for archiving. In case of online usage, the implementation shall record so that the contents recorded in Metadata File and Metadata Mirror File shall have the same offset in each file, although the offset of NWA in each track sometimes may not be the same due to the recording condition of each track.

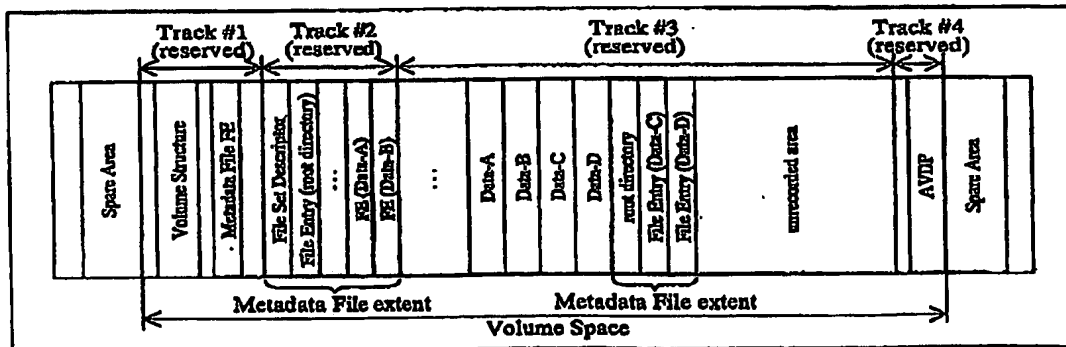
As an example of an intermediate state, a track layout after logical format is shown below. At first volume structure including AVDP at LSN 256 and the related file structure is recorded. Then, a track is assigned for metadata recording, and the metadata is recorded in the track. The reaming area in the volume space is used for file data recording as an incomplete track.



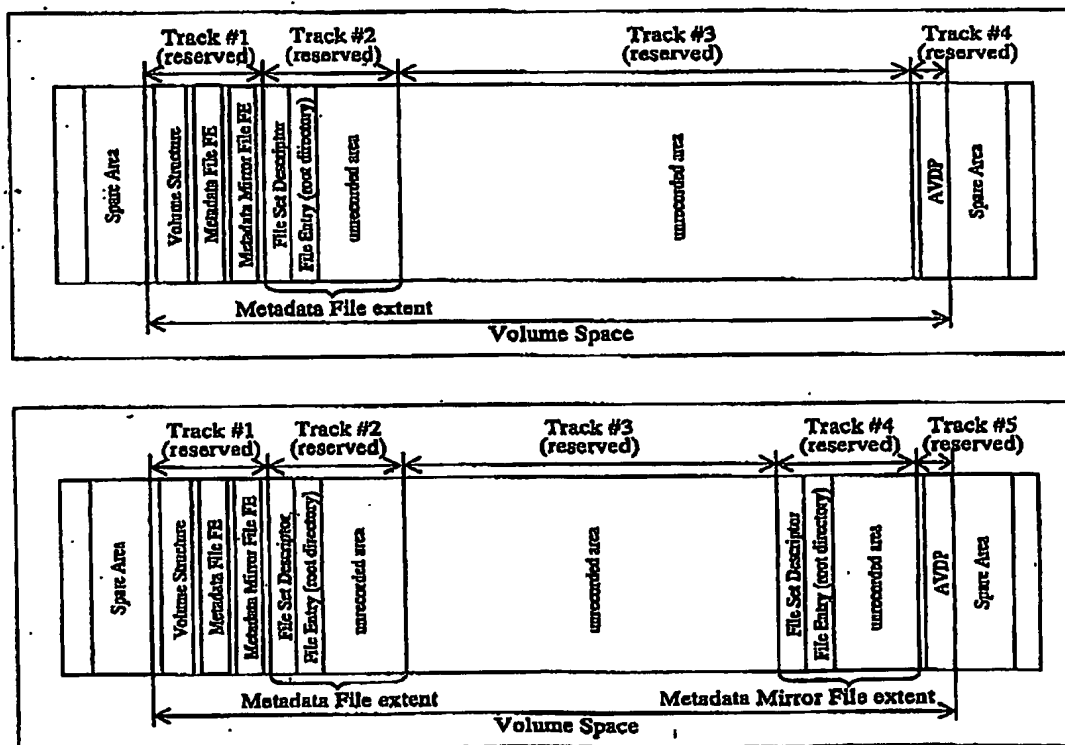
An example of a track layout after some files are recorded is shown below. After the first track is used up, a new track is assigned in the incomplete track. Thus, additional tracks may be assigned one after another.



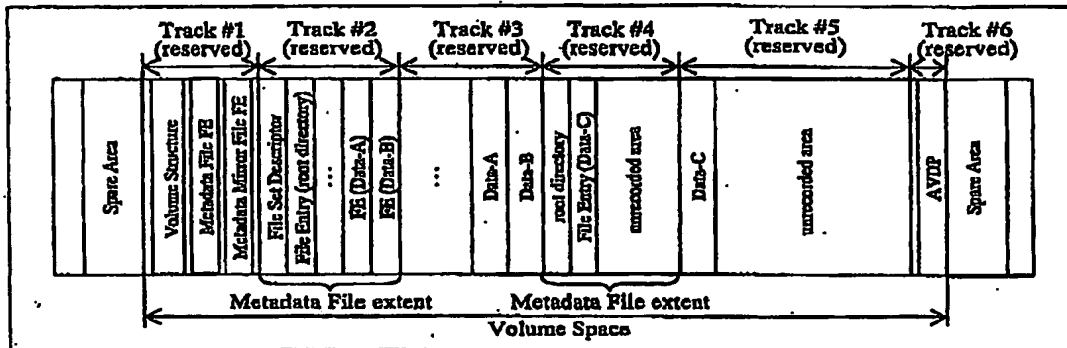
An example that a track to record the second AVDP is assigned is shown below. The track for metadata recording is used up, an additional area for Metadata File may be allocated in the data track as an extent, not a track.



Two examples of track layouts after logical format, according with ECMA 167 requirements to record AVDP at least two of three, are shown below. One is Duplicate Metadata Flag in Metadata Partition Map is set to zero, and another is set to one. At first volume structure including AVDP at LSN 256 and the related file structure are recorded. Then, a track is assigned for metadata recording, and the metadata is recorded in the track. In case of the second example, one more track for metadata recording is assigned for Metadata Mirror File, and the metadata is recorded in the track. The remaining area in the volume space is used for file data recording.



An example of a track layout after some files are recorded for the above first example is shown below. After the first track for metadata recording is used up, a new track is assigned in the track for file data recording. Thus, additional tracks may be assigned one after another.



Requirements for File System

The requirements for Pseudo-overwrite method are listed as follows:

- Implementations shall recognize Pseudo-overwritable media through inquiring to the drive unit.
- Access Type in Partition Descriptor shall be 4 (Overwritable).
- Unallocated Space Bitmap and Unallocated Space Table shall not be recorded.
- Metadata Bitmap File shall not be recorded.
- Implementation should always query for NWA in each track prior to write additional data recording. If a write command is issued to already recorded area, the defect list entry is used. Therefore, this requirement is very important to reduce unnecessary defect list entry as the size of defect list is limited.

- Deleted blocks should not reused for the same reason to query NWA.
- The metadata to be overwritten should be minimize. It is recommended only directory File Entry should be overwritten, and directory File Entries should be packed within an ECC block, if possible.
- When an additional extent of the Metadata Partition or Metadata Mirror File is assigned with a track reservation, the track shall be assigned on the same area as the additional extent.
- At least two tracks each of which has NWA shall be allowed, one is for metadata recording, and the other is user data recording. Maximum three tracks each of which has NWA shall be allowed, last one is for metadata recording of Metadata Mirror File.
- Each extent of Metadata File and Metadata Mirror File shall be a track, when Pseudo-overwrite media has no restriction for the track assignment after a track is assigned at the end of the volume space.